

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method for configuring a state machine implemented in a function block associated with a process plant, via a computing device having a display device and an input device, wherein the state machine defines a plurality of states and wherein the state machine transitions between states based on state machine configuration data and one or more state machine inputs, wherein the state machine inputs are associated with operation of the function block associated with a process plant, the function block to implement a state machine, the method comprising:

providing a graphical user interface via displayed by the display device, for configuring, at least in part, how the state machine is to transition among a plurality of states, wherein the graphical user interface includes including a plurality of graphical elements, wherein at least some of the graphical elements can be used to indicate desired transitions between states defining input/state pairs;

wherein the at least one input is to be associated with the process plant

receiving state transition data associated with one or more of the plurality of graphical elements via the graphical user interface input device, wherein for each of the one or more of the plurality of graphical elements for which state transition data is received, the state transition data identifies a next state to which the state machine transitions following conditions in the process plant corresponding to the input/state pairs defined by the graphical elements; and

storing the state transition data on a first computer readable medium associated with the function block.

2. (Currently Amended) A method according to claim 1, wherein the plurality of graphical elements comprises a first plurality of cells associated with the function block, wherein each cell of the first plurality of cells corresponds to ~~one of at least some possible pairings of ones of the at least one input and ones of the states of the plurality of states of the state machine~~ an input/state pair; and

wherein receiving the state transition data comprises receiving ~~respective~~ data associated with ~~each of at least some~~ one or more of the first plurality of cells via the input device, wherein the ~~respective~~ data is indicative of ~~a~~ one or more next state states to which the state machine ~~should~~ is to transition when the state machine is in ~~the~~ a state corresponding to ~~the cell~~ one of the one or more of the first plurality of cells and when the input corresponding to the ~~cell~~ one of the one or more of the first plurality of cells is a particular value.

3. (Currently Amended) A method according to claim 2, further comprising displaying the first plurality of cells on the display device and displaying indications of the state transition data in ~~appropriate cells~~ the one or more of the first plurality of cells for which state transition data have been received.

4. (Currently Amended) A method according to claim 2, wherein displaying ~~on the display device~~ the first plurality of cells on the display device comprises displaying ~~on the display device~~ a matrix comprising the first plurality of cells, the matrix comprising at least one row of cells and a plurality of columns of cells, wherein each row of

~~the at least one row cells~~ is associated with a ~~corresponding state machine input of the at least one input, and~~ wherein each column of ~~the plurality of columns~~ cells is associated with a ~~corresponding state one~~ of the plurality of states.

5. (Currently Amended) A method according to claim 2, wherein displaying ~~on the display device~~ the first plurality of cells on the display device comprises displaying ~~on the display device~~ a matrix comprising the first plurality of cells, the matrix comprising a plurality of rows of cells and at least one column of cells, wherein each row of the plurality of rows ~~cells~~ is associated with a ~~corresponding state one~~ of the plurality of states, and wherein each column of ~~the at least one column~~ cells is associated with a ~~corresponding input of the at least one state machine input.~~

6. (Currently Amended) A method according to claim 2, wherein the particular value of the input is one of a logical one, a logical zero, a logical TRUE value, and or a logical FALSE value.

7. (Currently Amended) A method according to claim 2, further comprising:

receiving data, via the input device, indicative of a number of the state machine inputs in the at least one input; and
~~determining a number of identifying~~ cells in the first plurality of cells based on the number of state machine inputs.

8. (Currently Amended) A method according to claim 7, further comprising:

receiving data, via the input device, indicative of a number of states in the plurality of states;

wherein determining identifying the number of cells in the first plurality of cells comprises determining the number of identifying cells based on the number of inputs and the number of states.

9. (Currently Amended) A method according to claim 2, further comprising:

receiving data, via the input device, indicative of a number of states in the plurality of states; and

determining identifying a number of cells in the first plurality of cells based on the number of states.

10. (Currently Amended) A method according to claim 2, wherein the plurality of graphical elements further comprises a second plurality of cells associated with the function block, wherein each cell of the second plurality of cells corresponds to a respective one of a plurality of outputs of the function block and a respective one of the plurality of states of the state machine;

receiving output configuration data associated with at least some one or more cells of the second plurality of cells via the input device, wherein respective output configuration data associated with each cell of the at least some of the one or more cells of

the second plurality of cells includes data indicative of an output value of the output corresponding to the cell when the state machine is in the state corresponding to the cell; and storing the output configuration data on a second computer readable medium associated with the function block.

11. (Original) A method according to claim 10, wherein the first computer readable medium comprises the second computer readable medium.

12. (Original) A method according to claim 1, further comprising:
receiving data indicative of how to handle inputs that have a BAD status; and
storing the data indicative of how to handle inputs that have the BAD status.

13. (Currently Amended) A method according to claim 1, wherein the ~~at least one input~~ one or more state machine inputs comprises a plurality of state machine inputs, the method further comprising:

receiving data, via the graphical user interface, indicative of priorities associated with the plurality of state machine inputs; and
storing the data indicative of how to handle inputs that have ~~the~~ a BAD status.

14. (Currently Amended) A method according to claim 1, further comprising receiving data indicative of whether one or more, if any, ~~of the at least one input~~ one or more state machine inputs should be ignored by the state machine; and

storing the data indicative of whether one or more, if any, ~~of the at least one input~~ one or more state machine inputs should be ignored by the state machine.

15. (Currently Amended) A method according to claim 1, wherein ~~the at least one input~~ the one or more state machine inputs is to be associated with at least one of a process control system, a simulation of a process control system, a safety system, and a simulation of a safety system.

16. (Currently Amended) A method according to claim 1, wherein ~~the at least one input~~ one or more state machine inputs is to be received from at least one other function block associated with the process plant.

17. (Currently Amended) A method according to claim 1, wherein ~~the at least one input~~ one or more state machine inputs is to be received from an operator interface.

18. (Currently Amended) A tangible medium storing machine readable instructions comprising:

first code to provide a graphical user interface via ~~the a~~ display device for configuring, ~~at least in part, how the state machine is to transition~~ transitions among a plurality of states, ~~wherein the graphical user interface includes~~ ~~including~~ a plurality of graphical elements ~~representing state machine input/state pairs which,~~ ~~wherein at least some of the graphical elements~~ can be used to indicate desired transitions between states; ~~wherein the at least one input is to be associated with the process plant;~~

second code to receive state transition data identifying a state machine next state associated with one of the graphical elements via the graphical user interface; and
third code to store the state transition data on a computer readable medium associated with the-a function block implementing a state machine in a process plant such that the state machine transitions to the next state when conditions in the process plant correspond to the input/state pair associated with the graphical element.

19. (Currently Amended) A tangible medium according to claim 18, wherein the plurality of graphical elements comprises a first plurality of cells associated with the function block, wherein each cell of the first plurality of cells corresponds to ~~one of at least some possible pairings of ones of the at least one input and ones of the states of the plurality of states of the-a state machine input/state pair; and~~

wherein the second code comprises fourth code to receive respective data associated with ~~each of at least some one or more~~ of the first plurality of cells via an input device of the computing device, wherein the respective data is indicative of a next state to which the state machine ~~should-is to~~ transition when the state machine is in the state corresponding to the cell and when the input corresponding to the cell is a particular value.

20. (Original) A tangible medium according to claim 19, further comprising fifth code to display on the display device indications of the state transition data in appropriate cells of the first plurality of cells.

21. (Currently Amended) A tangible medium according to claim 19, wherein the first code comprises fifth code to display on the display device a matrix comprising the first plurality of cells, the matrix comprising at least one row of cells and a plurality of columns of cells, wherein each row of the at least one row is associated with a corresponding input of the at least one corresponds to a state machine input, and wherein each column of the plurality of columns is associated with a corresponding state of the plurality of states state machine state.

22. (Currently Amended) A tangible medium according to claim 19, wherein the first code comprises fifth code to display on the display device a matrix comprising the first plurality of cells, the matrix comprising a plurality of rows of cells and at least one column of cells, wherein each row of the plurality of rows is associated with a corresponding state of the plurality of states corresponds to a state machine, and wherein each column of the at least one column is associated with a corresponding input of the at least one state machine input.

23. (Currently Amended) A tangible medium according to claim 19, wherein the particular value is one of a logical one, a logical zero, a logical TRUE value, and or a logical FALSE value.

24. (Currently Amended) A tangible medium according to claim 19, further comprising:

fifth code to receive data, via the input device, indicative of a ~~number~~ plurality of state machine inputs ~~in the at least one input~~; and

sixth code to determine a number of cells in the first plurality of cells based on the number of inputs.

25. (Currently Amended) A tangible medium according to claim 24, further comprising:

seventh code to receive data, via the input device, indicative of a number of state machine states ~~in the plurality of states~~;

wherein the sixth code comprises code to determine the number of cells based on the number of state machine inputs and the number of state machine states.

26. (Currently Amended) A tangible medium according to claim 19, further comprising:

fifth code to receive data, via the input device, data indicative of a number of state machine states ~~in the plurality of states~~; and

sixth code to determine a number of cells in the first plurality of cells based on the number of state machine states.

27. (Original) A tangible medium according to claim 19, wherein the plurality of graphical elements comprises a second plurality of cells associated with the function block, wherein each cell of the second plurality of cells corresponds to a respective

one of a plurality of outputs of the function block and a respective one of the plurality of states of the state machine;

sixth code to receive output configuration data associated with at least some of the second plurality of cells via the input device, wherein respective output configuration data associated with each cell of the at least some of the second plurality of cells includes data indicative of an output value of the output corresponding to the cell when the state machine is in the state corresponding to the cell; and

seventh code to store the output configuration data.

28. (Currently Amended) A tangible medium according to claim 18, wherein the ~~at least one input comprises state machine inputs comprise~~ a plurality of inputs, the tangible medium further comprising:

fourth code to receive data, via the input device, indicative of priorities associated with the plurality of state machine inputs; and
fifth code to store the data indicative of the priorities.

29. (Currently Amended) A tangible medium according to claim 18, further comprising:

fourth code to receive data indicative of how to handle state machine inputs that have a BAD status; and
fifth code to store the data indicative of how to handle state machine inputs that have a BAD status.

30. (Currently Amended) A tangible medium according to claim 18,
further comprising:

fourth code to receive data indicative of whether to ignore one or more, if any,
of the ~~at least one input state machine inputs~~; and
fifth code to store the data indicative of whether to ignore one or more, if any,
of the ~~at least one input state machine inputs~~.

31. (Currently Amended) A tangible medium according to claim 18,
wherein ~~the~~ at least one state machine input is to be associated with at least one of a process
control system, a simulation of a process control system, a safety system, ~~and~~or a simulation
of a safety system.

32. (Currently Amended) A tangible medium according to claim 18,
wherein ~~the~~ at least one state machine input is to be received from at least one other function
block associated with the process plant.

33. (Currently Amended) A tangible medium according to claim 18,
wherein ~~the~~ at least one state machine input is to be received from an operator interface.

34. (Currently Amended) A method of implementing a state machine in a
function block for use in controlling, or simulating control of, one or more field devices in a
process plant, the method comprising:

providing a graphical user interface ~~via the~~ displayed by a display device, the graphical user interface including a plurality of graphical elements for configuring, at least in part, how the state machine is to transition among transitions between a plurality of state machine states, wherein the graphical user interface includes a plurality of graphical elements, wherein at least some of the graphical elements can be used to indicate desired transitions between states; the graphical elements defining one or more state machine input/state pairs, wherein the at least one input is to be one or more state machine inputs are indicative of one or more conditions within the process plant;

receiving state transition data identifying a state machine next state associated with at least one of the graphical elements via an interface input associated with the graphical user interface;

storing the state transition data on a first computer readable medium associated with the function block;

receiving the at least one state machine input, wherein the at least one input is associated with the process plant;

determining a state machine next state based, at least in part, on at least one of the at least one input, a current state, and the state transition data stored on a the first computer readable medium;

setting the current state of the state machine to the state machine next state;
and

providing at least one function block output for use in controlling the one or more field devices to at least a second other function block, wherein the at least one function block output is based on the current state of the state machine.

35. (Currently Amended) A method according to claim 34, wherein the ~~at least one input~~ one or more state machine inputs comprises a plurality of state machine inputs;

wherein determining the state machine next state ~~comprises determining the next state is~~ further based on priorities associated with the plurality of state machine inputs.

36. (Currently Amended) A method according to claim 35, wherein ~~determining the next state further based on priorities associated with the plurality of inputs~~ ~~comprises determining the state machine next state further is~~ based on an order ~~determined by the priorities~~ associated with the plurality of state machine inputs.

37. (Currently Amended) A method according to claim 34, further comprising:

determining whether a state transition is to occur based on ~~the received at least one of the at least one state machine input~~ and the state transition data stored on the first computer readable medium;

wherein determining the next state comprises determining the next state if a state transition is to occur; and

wherein setting the current state of the state machine to the next state comprises setting the current state of the state machine to the next state if a state transition is to occur.

38. (Currently Amended) A method according to claim 34, wherein determining the next state comprises determining whether one or more, if any, of the received at least one input that state machine inputs is a particular value.

39. (Currently Amended) A method according to claim 38, wherein determining the next state further comprises determining whether one or more, if any, of the one or more of the received at least one input state machine inputs that are the a particular value and that also correspond to state changes based on the state transition data stored on the first computer readable medium.

40. (Currently Amended) A method according to claim 39, further comprising selecting one of the one or more, if any, of the received at least one input inputs that are the a particular value and that correspond to state changes.

41. (Currently Amended) A method according to claim 40, wherein the at least one input comprises a plurality of inputs;

wherein selecting one of the one or more, if any, of the received at least one input inputs that are the a particular value and that correspond to state changes comprises selecting one of the one or more of the received at least one inputs that are a particular value based on priorities associated with the plurality of inputs.

42. (Currently Amended) A method according to claim 41, wherein selecting one of the one or more, if any, of the received at least one input inputs that are the a

particular value and that correspond to state changes comprises selecting one of the one or more of the received at least one inputs that are a particular value based on an order associated with the plurality of inputs.

43. (Currently Amended) A method according to claim 34, wherein determining the next state comprises determining one or more, if any, of the received at least one input-inputs associated with potential state changes from the current state based on the state transition data stored on the first computer readable medium.

44. (Currently Amended) A method according to claim 43, wherein determining the next state further comprises determining one or more, if any, of the one or more of the received at least one input-inputs associated with potential state changes from the current state and that also are a particular value.

45. (Original) A method according to claim 34, wherein providing the at least one function block output comprises providing a plurality of function block outputs.

46. (Original) A method according to claim 45, wherein each of at least some of the plurality of function block outputs are indicative of whether the current state of the state machine corresponds to a respective one of a plurality of possible states of the state machine.

47. (Original) A method according to claim 45, wherein providing the plurality of function block outputs comprises:

retrieving, based on at least the current state, data indicative of appropriate values for at least some of the plurality of state machine function block outputs from an output configuration database; and

setting the at least some of the plurality of function block outputs to the appropriate values.

48. (Original) A method according to claim 45, wherein providing the plurality of function block outputs comprises providing one function block output indicative of the current state of the state machine.

49. (Currently Amended) A method according to claim 34, wherein the at least one function block output comprises ~~one~~a function block output ~~that is~~ indicative of the current state of the state machine.

50. (Original) A method according to claim 34, further comprising:
receiving an input indicative of whether the state machine function block is to be disabled; and

if the input indicative of whether the state machine function block is to be disabled indicates that the state machine function block is to be disabled, setting the current state of the state machine to a disabled state.

51. (Original) A method according to claim 50, further comprising:
receiving an input indicative of whether the state machine function block is to
be forced to an initial state; and
if the input indicative of whether the state machine function block is to be
forced to the initial state indicates that the state machine function block should be forced to
the initial state, setting the current state of the state machine to the initial state;
wherein the input indicative of whether the state machine function block is to be
enabled and the input indicative of whether the state machine function block is to be
forced to the initial state comprise a single input.

52. (Original) A method according to claim 34, further comprising:
receiving an input indicative of whether the state machine function block is to be
forced to an initial state; and
if the input indicative of whether the state machine function block is to be
forced to the initial state indicates that the state machine function block should be forced to
the initial state, setting the current state of the state machine to the initial state.

53. (Currently Amended) A method according to claim 34, wherein
~~receiving the at least one data input to the state machine function block-state machine input~~
comprises receiving at least one signal associated with at least one of a process control
system, a simulation of a process control system, a safety system, and a simulation of a safety
system.

54. (Currently Amended) A method according to claim 34, wherein the at least one state machine input is to be received from at least one other function block associated with the process plant.

55. (Currently Amended) A method according to claim 34, wherein the at least one state machine input is to be received from an operator interface.

56. (Original) A method according to claim 34, wherein providing the at least one function block output comprises providing the at least one function block output to a portion of a process control system, wherein the portion of the process control system controls the one or more field devices based, at least in part, on the at least one function block output.

57. (Original) A method according to claim 34, wherein providing the at least one function block output comprises providing the at least one function block output to a portion of a safety system, wherein the portion of the safety system controls the one or more field devices based, at least in part, on the at least one function block output.

58. (Currently Amended) A function block entity for use in a process plant having a processor adapted to control, or to simulate control of, one or more field devices, the function block entity comprising:

a user modifiable state machine configuration database including state transition data indicative of how a state machine implemented by the function block is to

transition among a plurality of states, wherein the state transition data comprises data, for each of the at least some potential pairings of state machine each of at least some of the plurality of states and each of at least some of at least one input one or more corresponding function block inputs, to the function block, the state transition data indicative of a next state to which the state machine should is to transition when the state machine is in the a state corresponding state to a particular one of the pairings and when the corresponding input corresponding to the particular one of the pairings is a particular value;

a first computer readable medium;

first code stored on the first computer readable medium to receive the at least one input inputs to the function block, wherein the at least one input comprises inputs comprise data associated with the process plant;

second code stored on the first computer readable medium to determine a next state of the state machine, wherein the determination is to be based, at least in part, on at least one of the at least one input, a current state of the state machine, and the state transition data, wherein the second code is fixed;

third code stored on the first computer readable medium to set the current state of the state machine to the next state, wherein the third code is fixed; and

fourth code stored on the first computer readable medium to provide at least one function block output for use in controlling the one or more field devices.

59. (Original) A function block entity according to claim 58, wherein the state machine configuration database is stored on the first computer readable medium.

60. (Original) A function block entity according to claim 58, wherein the state machine configuration database is stored on a second computer readable medium different from the first computer readable medium.

61. (Currently Amended) A function block entity according to claim 58, wherein the ~~at least one input comprises one or more corresponding function block inputs comprise~~ a plurality of inputs;

wherein the second code comprises fifth code stored on the first computer readable medium to determine the next state further based on priorities associated with the plurality of inputs.

62. (Original) A function block entity according to claim 61, wherein the fifth code comprises code to determine the next state further based on an order associated with the plurality of inputs.

63. (Currently Amended) A function block entity according to claim 58, further comprising:

fifth code stored on the first computer readable medium to determine whether a state transition is to occur based on at least one of the ~~at least one input one or more corresponding function block inputs~~ and the state transition data;

wherein the second code comprises code to determine the next state if a state transition is to occur; and

wherein the third code comprises code to set the current state of the state machine to the next state if a state transition is to occur.

64. (Currently Amended) A function block entity according to claim 58, wherein the second code comprises fifth code stored on the first computer readable medium to determine one or more~~which~~, if any, of the ~~at least one input that is inputs to the function block~~ are the particular value.

65. (Currently Amended) A function block entity according to claim 64, wherein the second code further comprises sixth code stored on the first computer readable medium to determine one or more~~which~~, if any, of the ~~one or more of the at least one input that is inputs to the function block are~~ the particular value and ~~that which also corresponds correspond~~ to a state change based, at least in part, on the state transition data.

66. (Currently Amended) A function block entity according to claim 65, further comprising seventh code stored on the first computer readable medium to select one, ~~of the one or more, if any, of the at least one input if any, of the inputs to the function block that is~~ are the particular value and that ~~corresponds correspond~~ to a state change, ~~if there is at least one of the at least one input that is the particular value and that corresponds to a state change from the current state.~~

67. (Currently Amended) A function block entity according to claim 66, wherein the ~~at least one input~~ one or more function block inputs ~~comprises~~ comprise a plurality of inputs;

wherein the seventh code comprises eighth code stored on the first computer readable medium to select the one of the ~~at least one input~~ function block inputs based on priorities associated with the plurality of function block inputs.

68. (Currently Amended) A function block entity according to claim 67, wherein the eighth code comprises code to select one of the function block inputs of the plurality of function block inputs based on an order associated with the plurality of function block inputs.

69. (Currently Amended) A function block entity according to claim 58, wherein the second code comprises fifth code stored on the first computer readable medium to determine one or more, if any, of the ~~at least one or more function block input~~ inputs that would cause a state change from the current state based on the state transition data stored on the second computer readable medium.

70. (Currently Amended) A function block entity according to claim 69, wherein the second code further comprises sixth code stored on the first computer readable medium to determine whether one or more, if any, of the one or more ~~of the at least one input~~ function block inputs that would cause a state change ~~and that is also~~ is the particular value.

71. (Original) A function block entity according to claim 58, wherein the fourth code comprises fifth code stored on the first computer readable medium to provide a plurality of function block outputs.

72. (Currently Amended) A function block entity according to claim 71, wherein the fifth code comprises code to provide each of at least some of the plurality of function block outputs, ~~that wherein the lat least some of the plurality or function block outputs~~ are indicative of whether the current state of the state machine corresponds to a respective one of a plurality of possible states of the state machine.

73. (Original) A function block entity according to claim 71, wherein the fifth code comprises:

sixth code stored on the first computer readable medium to retrieve, based on at least the current state, data indicative of appropriate values for at least some of the plurality of state machine function block outputs from a user configurable output configuration database; and

seventh code stored on the first computer readable medium to set the at least some of the plurality of function block outputs to the appropriate values.

74. (Original) A function block entity according to claim 73, wherein the state machine configuration database and the output configuration database are stored on a same computer readable medium.

75. (Original) A function block entity according to claim 73, wherein the state machine configuration database and the output configuration database are stored on different computer readable media.

76. (Original) A function block entity according to claim 58, further comprising:

fifth code stored on the first computer readable medium to receive an input indicative of whether the state machine function block is to be disabled; and
sixth code stored on the first computer readable medium to set the current state of the state machine to a disabled state if the input indicative of whether the state machine function block is to be disabled indicates that the state machine function block is to be disabled.

77. (Currently Amended) A function block entity according to claim 58, further comprising:

fifth code stored on the first computer readable medium to receive an input indicative of whether the state machine function block is to be forced to an initial state; and
sixth code stored on the first computer readable medium to set the current state of the state machine to the initial state if the input indicative of whether the state machine function block is to be forced to the initial state indicates that the state machine function block should be forced to the initial state.

78. (Currently Amended) A function block entity according to claim 58, wherein the ~~at least one data input comprises inputs to the function block comprise at least one signal associated with at least one of a process control system, a simulation of a process control system, a safety system, and/or a simulation of a safety system.~~

79. (Currently Amended) A function block entity according to claim 58, further comprising fifth code stored on the first computer readable medium to mask one or more, if any, of the ~~at least one input~~inputs to the function block.